PHYS 122: University Physics II: Electricity & Magnetism

Term: Fall 2026
Credits: 4.0
Meeting Times & Location: Multiple sections. Your section's days, time, room, and instructor are listed in AlkimiHub and on your Canvas course page.
Modality: In-Person

Instructor Information

- **Course Coordinator:** Dr. Megan Hollander (Assistant Teaching Professor of Physics)
- **Section Instructors:** Listed for each section in AlkimiHub. Your section instructor's office hours and office are posted in your Canvas course page.
- **Email:** mhollander@university.alkimi.ai
- **Office:** Meridian Science Center 414
- **Coordinator Office Hours:**
  - Monday & Wednesday: 3:00–4:30 p.m. (In person, Meridian Science Center 414)
  - Tuesday: 11:00 a.m.–12:00 p.m. (Virtual via Zoom; link posted in Canvas)
  - Also available by appointment.

Course Description

Calculus-based electrostatics, Gauss's law, electric potential, capacitance, DC circuits, magnetic fields, induction, AC circuits, and electromagnetic waves, with a weekly three-hour laboratory. PHYS 122 completes the foundational calculus-based introductory physics sequence, investigating electromagnetic interactions that govern atomic matter and technological infrastructure. Students apply multivariable vector calculus to understand electrostatics, Gauss's law, electric potential, capacitance, direct-current circuits, magnetic fields and forces, Ampère's law, Biot-Savart law, electromagnetic induction, alternating-current circuits, and Maxwell's equations leading to electromagnetic radiation.

Prerequisites

PHYS 121; MATH 141 (prior or concurrent).

Measurable Student Learning Outcomes

Upon successful completion of PHYS 122, students will be able to:

1. **Calculate Electric Fields and Apply Gauss's Law:** Compute electric fields for discrete and continuous charge configurations using Coulomb's law and apply Gauss's law to highly symmetric charge distributions.
2. **Determine Electric Potential and Capacitance:** Calculate electric potential and electrostatic potential energy, and analyze capacitance, dielectric materials, and energy storage in capacitors.

3. **Analyze Direct-Current Circuits:** Apply Ohm's law, Kirchhoff's junction and loop rules, and RC transient equations to multi-loop and time-dependent direct-current circuits.
4. **Evaluate Magnetic Fields and Biot-Savart Law:** Determine magnetic forces on moving charges and current-carrying wires, and calculate magnetic fields using the Biot-Savart law and Ampère's law.
5. **Apply Faraday's Law and Induction:** Calculate induced electromotive force using Faraday's law of induction and Lenz's law, analyze mutual and self-inductance, and model RL/RLC circuits.
6. **Synthesize Maxwell's Equations and Wave Propagation:** Formulate Maxwell's equations in integral form and deduce the speed, energy transport (Poynting vector), and polarization of electromagnetic waves.

Required Course Materials & Approximate Costs

1. **Halliday, David, Robert Resnick, and Jearl Walker. *Fundamentals of Physics*. 12th ed., Wiley, 2021.** Approx. $65 for digital access; approx. $140 for print purchase.
2. **OpenStax University Physics, Volume 2. Free digital access at openstax.org.** Free.
3. **Scientific calculator with trigonometric and algebraic functions (graphing calculators prohibited on exams).** Approx. $15 to $25.
4. **Total estimated cost:** $15 to $165.

Generative AI Policy (AI Level 2: AI Permitted with Disclosure for Specified Tasks)

In accordance with Alkimi University Academic Policies (Student Handbook §5.8), PHYS 122 operates under **AI Level 2**.

- **What is permitted:** You may use Alkimi or other approved AI tools to visualize 3D vector fields, generate practice integration problems for continuous charge distributions, or clarify the conceptual meaning of Maxwell's equations.
- **What is prohibited:** You may not use AI tools to generate answers for assigned weekly homework sets, compose lab notebook conclusions, or access generative platforms during quizzes, midterms, or the common final exam.
- **Disclosure:** Include an explicit AI disclosure statement on each submitted problem set specifying any AI platforms consulted, prompts entered, and verification steps taken, or state that no AI tools were used.

Grading Components and Weights

- **Midterm Exam 1:** 15% (In class during week 5 (week of September 21))
- **Midterm Exam 2:** 15% (In class during week 10 (week of October 26))
- **Weekly Problem Sets:** 20% (Due Fridays at 11:59 p.m. in Canvas (weeks 2–13; lowest dropped))
- **Laboratory Investigations & Reports:** 20% (Weekly laboratory write-ups submitted in Canvas; sections meet weekly)
- **Weekly Concept Quizzes:** 5% (Canvas pre-lecture quizzes due Tuesdays at 11:59 p.m.; lowest two dropped)
- **Common Final Examination:** 25% (Friday, December 11, 2026, 1:30–3:30 p.m.)

Grading Scale (Alkimi University Standard)

- **A:** 93–100% | **A-:** 90–92%
- **B+:** 87–89% | **B:** 83–86% | **B-:** 80–82%
- **C+:** 77–79% | **C:** 73–76% | **C-:** 70–72%
- **D+:** 67–69% | **D:** 60–66% | **F:** Below 60%
- **Extra credit:** No extra credit assignments are offered in coordinated multi-section courses.

Course Schedule (Fall 2026)

All sections follow this common weekly schedule. Section meeting days vary, so dates are shown by week; your section instructor posts exact class dates in Canvas.

Week	Dates	Topics & Readings	Assignments & Deadlines
Week 1	Aug 26–Aug 28	**Electric Charge, Coulomb's Law, and Superposition:** Quantization of charge, conservation of charge, Coulomb's law, electrostatic force vectors, and superposition principle. *Reading: Halliday Ch. 21*	*First day of classes: Wed Aug 26.*
Week 2	Aug 31–Sep 4	**Electric Fields and Continuous Charge Distributions:** Electric field lines, field of point charges, electric dipoles, line integrals for continuous charge distributions (lines, rings, disks). *Reading: Halliday Ch. 22*	*Wed Sep 2: Add/section change deadline.*
Week 3	Sep 8–Sep 11	**Gauss's Law and Flux Calculations:** Electric flux, surface integrals, Gauss's law formulation, spherical, cylindrical, and planar symmetries, and conductors in electrostatic equilibrium. *Reading: Halliday Ch. 23*	*Mon Sep 7: Labor Day (no classes). Wed Sep 9: Census date (last day to drop without a W).*
Week 4	Sep 14–Sep 18	**Electric Potential and Potential Energy:** Work and electric potential energy, line integral of electric field, potential of point charges and continuous distributions, and equipotential surfaces. *Reading: Halliday Ch. 24*	—
Week 5	Sep 21–Sep 25	**Capacitance, Dielectrics, and Energy & Midterm Exam 1:** Parallel-plate, cylindrical, and spherical capacitors, combinations of capacitors, energy density, and dielectric polarization; Midterm Exam 1 in class. *Reading: Halliday Ch. 25*	**Midterm Exam 1 (in class this week).**
Week 6	Sep 28–Oct 2	**Electric Current, Resistance, and Ohm's Law:** Current density, drift velocity, resistivity and resistance, Ohm's law microscopic derivation, electrical power, and Joule heating. *Reading: Halliday Ch. 26*	—
Week 7	Oct 5–Oct 9	**Direct-Current Circuits and Kirchhoff's Rules:** Electromotive force, internal resistance, resistors in series and parallel, and Kirchhoff's junction and loop rules. *Reading: Halliday Ch. 27.1–27.3*	—
Week 8	Oct 14–Oct 16	**RC Circuits and Transient Analysis:** Charging and discharging capacitors, differential equations for RC circuits, capacitive time constant, and power transfer. *Reading: Halliday Ch. 27.4–27.9*	*Oct 12–Oct 13: Fall break (no classes). Fri Oct 16: Midterm grades due.*
Week 9	Oct 19–Oct 23	**Magnetic Fields and Magnetic Forces:** Lorentz force law, charged particle motion in magnetic fields, cyclotron frequency, Hall effect, and torque on current loops. *Reading: Halliday Ch. 28*	—
Week 10	Oct 26–Oct 30	**Sources of Magnetic Fields & Midterm Exam 2:** Biot-Savart law for wires and loops, force between parallel currents, Ampère's law, solenoids, and toroids; Midterm Exam 2 in class. *Reading: Halliday Ch. 29*	**Midterm Exam 2 (in class this week).**
Week 11	Nov 2–Nov 6	**Faraday's Law of Induction and Lenz's Law:** Magnetic flux, Faraday's law, Lenz's law, motional emf, induced electric fields, and eddy currents. *Reading: Halliday Ch. 30.1–30.4*	*Fri Nov 6: Last day to withdraw (W) or elect Pass/No Pass.*
Week 12	Nov 9–Nov 13	**Inductance, RL Circuits, and Magnetic Energy:** Self-inductance, mutual inductance, RL circuit transient analysis, inductive time constant, and magnetic energy density. *Reading: Halliday Ch. 30.5–30.11*	—
Week 13	Nov 16–Nov 20	**Alternating Current and RLC Resonant Circuits:** Phasors, capacitive and inductive reactance, impedance in series RLC circuits, power factor, and resonance. *Reading: Halliday Ch. 31*	—

Week	Dates	Topics & Readings	Assignments & Deadlines
Week 14	Nov 23–Nov 24	**Displacement Current and Maxwell's Equations:** Ampère-Maxwell law, displacement current concept, Maxwell's four equations in integral form, and magnetic monopoles. *Reading: Halliday Ch. 32*	*Nov 25–Nov 27: Thanksgiving break (no classes).*
Week 15	Nov 30–Dec 4	**Electromagnetic Waves and Energy Transport:** Wave equation derivation from Maxwell's equations, speed of light, Poynting vector, radiation pressure, and polarization. *Reading: Halliday Ch. 33*	—
Week 16	Dec 7–Dec 9	**Wave Optics Foundations and Common Final Review:** Interference, diffraction, wave-particle duality prelude, and comprehensive synthesis of electromagnetism concepts. *Reading: Halliday Ch. 34 & Review*	*Wed Dec 9: Last day of classes. Thu Dec 10: Reading Day.*
Finals	Dec 11	**Common Final Examination:** Friday, December 11, 2026, 1:30–3:30 p.m., rooms by section, posted in Canvas.	Comprehensive examination covering all electromagnetism topics, circuits, induction, and Maxwell's equations.

Course Policies

Attendance Policy

Mastering electromagnetism requires consistent, active participation in both lectures and laboratory experiments. If an unavoidable illness or approved university conflict forces an absence, notify Dr. Hollander and your lab instructor in advance. Accumulating more than two unexcused lab absences results in course failure. Students who miss the first two class meetings without notifying the instructor may be dropped. Students may miss class for religious observance without penalty if they notify the instructor in writing within the first two weeks of the semester (by Wednesday, September 9, 2026). Absences for university-sponsored activities (athletics, performances, conferences) are excused with a letter from the sponsoring office at least one week in advance.

Late Work Policy

Homework problem sets submitted within 24 hours of the Friday deadline receive a 20% deduction; no problem sets are accepted after 24 hours because detailed solutions are released. Pre-lecture quizzes close strictly at the deadline, though the two lowest quiz grades are dropped automatically.

Final Exam Policy

The final examination (Friday, December 11, 2026, 1:30–3:30 p.m.) is a common exam for all sections, scheduled by the University Registrar and can't be moved without the Dean's written approval (Faculty Handbook §5.5). A student with three or more final exams on the same calendar day may reschedule one of them. Requests go to the instructor of the middle exam by the last day of classes. For this term, send the request by Wednesday, December 9, 2026 (Student Handbook §6.4).

Academic Integrity

Alkimi University is an academic community devoted to rigorous scholarship, open intellectual inquiry, and uncompromising ethical conduct. All students are subject to the regulations of the Alkimi University Academic Integrity Policy. Academic dishonesty—including plagiarism, cheating on examinations, unauthorized collaboration, fabrication of empirical data, and unauthorized submission of academic work generated by artificial intelligence—undermines the integrity of the university and carries severe disciplinary sanctions. Sanctions range from a failing grade on an assignment or exam to an administrative course failure recorded as an 'XF' on the official transcript, academic suspension, or expulsion. Suspected violations are formally investigated and resolved through the Office of Academic Integrity in accordance

with Faculty Handbook §6. For detailed information, consult the Office of Academic Integrity, Lovell Hall 315, (555) 555-0163, integrity@university.alkimi.ai.

Accessibility Services

Alkimi University is committed to providing equitable educational access and reasonable accommodations for all students with documented disabilities, including physical, sensory, psychological, learning, and chronic health conditions. Students requesting academic accommodations must formally register with the Office of Accessibility Services, Harlan Hall 204, (555) 555-0155, access@university.alkimi.ai. Once approved, students will receive an official Faculty Accommodation Letter detailing approved accommodations. Students should present this letter to the instructor as early in the semester as possible, and at least one week prior to any exam or assignment requiring accommodation. Accommodations cannot be applied retroactively.

Student Wellness and Mental Health

Your physical health, psychological well-being, and mental health are essential to your academic success. If you experience heightened stress, anxiety, depressive symptoms, personal trauma, or academic burnout, free, confidential counseling and medical care are available through the Hollis Health & Counseling Center, located in the Hollis Center. Routine appointments are available Monday–Friday 8:00 a.m.–6:00 p.m. and Saturday 10:00 a.m.–2:00 p.m. during the semester by calling (555) 555-0190 or emailing health@university.alkimi.ai. Urgent, 24/7 crisis psychological counseling is accessible immediately at (555) 555-0199.

Campus Student Support Services

- **Academic Advising Center:** Lovell Hall 101 | (555) 555-0158 | advising@university.alkimi.ai
- **Writing Center:** Whitcombe Library 3rd Floor | Free consultations on papers, reports, and research projects at any stage.
- **Whitcombe Library:** Whitcombe Library, Main Floor | (555) 555-0170 | askalibrarian@university.alkimi.ai
- **Hollis Health & Counseling Center:** Hollis Center | (555) 555-0190 | 24/7 Counseling Line: (555) 555-0199 | health@university.alkimi.ai
- **Physics Tutoring Center:** Drop-in peer tutoring and problem-solving consultations Monday through Thursday from 2:00 to 6:00 p.m.